PROCEEDINGS

OF

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February 26, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

Lieut. Kay, R.N., and Major Moore were elected Fellows of the Society.

"Illustrations of the Viscous Theory of Glaciers." By James David Forbes, Esq., F.R.S. &c. Part III.

The author inquires, in this part of his paper, into the motion of those comparatively small isolated glacial masses, reposing in the cavities of high mountains or on *cols*, and called by De Saussure *glaciers of the second order*. A glacier of this description in the neighbourhood of the Hospice du Simplon, lodged in a niche on the northern face of the Schœnhorn, immediately behind the Hospice, and at an elevation of about 8000 feet above the sea, was selected for observation. The average velocity of its descent was found to be about one inch and a half in twenty-four hours: those parts in which the slope was 20° moving with a velocity about one-third greater than those in which the slope was 10°. The author next enters into general views on the annual motion of glaciers, and on the influence of seasons; and gives tabular details of the observations made with reference to these questions at two stations; the one on the Glacier des Bossons, and the other at the Glacier des Bois, which is the outlet of the Mer de Glace towards the valley of Chamouni. In both these glaciers, the motion in summer exceeds that in winter in a greater proportion as the station is lower, and consequently exposed to more violent alternations of heat and cold. He also found that the variations of velocity due to season are greatest where the variations in the temperature of the air are greatest, as in the lower valleys; excepting that variations of temperature below the freezing-point produce scarcely any appreciable change in the rate of motion of the ice. He concludes with some general illustrations of the plastic or viscous theory of glacier motion. A glacier, he contends, is not a mass of fragments or parallelopipedons; neither is it a rigidly solid body; and although it may be extensively intersected by crevices, these "crevasses" are comparatively superficial, and do not disturb the general continuity of the mass in which they occur. The water contained in these crevices is only the principal vehicle of the force which acts upon it: and the irresistible energy with which the whole icy mass descends from hour to hour with a slow but continuous motion bespeaks of itself the operation of a fluid pressure acting on a ductile or plastic material.

March 5, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Physics of Media that are composed of free and perfectly elastic Molecules in a state of Motion." By J. J. Waterson, Esq. Communicated by Captain Beaufort, R.N., F.R.S.

This memoir contains the enunciation of a new theory of heat, capable of explaining the phenomena of its radiation and polarization, and the elasticity of various bodies, founded on the hypothesis of a medium consisting of a vast multitude of minute particles of matter endowed with perfect elasticity, and enclosed in elastic walls, but moving in all directions within that space, with perfect freedom, and in every possible direction. In the course of these motions, the particles must be supposed to encounter one another in every possible manner, during an interval of time so small as to allow of their being considered infinitesimal in respect to any sensible period; still, however, preserving the molecular *vis viva* constant and undiminished.

The author then enters into extensive analytical investigations; first, of the conditions that determine the equilibrium of such a homogeneous medium, as is implied by the hypothesis, and of the laws of its elasticity; secondly, of the physical relations of media that differ from each other in the specific weight of their molecules; thirdly, of the phenomena that attend the condensing and dilating of media, and of the mechanical value of their molecular *vis viva*; fourthly, of the resistance of media to a moving surface; fifthly, of the vertical equilibrium of a medium surrounding a planet and constituting its atmosphere; and lastly, of the velocity with which impulses are transmitted through a medium so constituted.

In an Appendix, the author enters into a full explanation of a table of gases and vapours, drawn up with reference to the subjects discussed in his paper.

March 12, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Blow-hole of the Porpoise." By Francis Sibson, Esq. Communicated by Thomas Bell, Esq., F.R.S.

The external opening of the air-passage of the porpoise is so situated at the upper part of the head as to admit of the animal's breathing while only a small portion of its head is above the water. In its descent through the skull, between the cranial and facial bones, the tube is divided by a thin plate of bone into two nasal canals, which form, below this partition, a single muscular tube opening at its lower part into the pharynx by a constricted aperture, through which the larynx projects upwards quite through the pharynx, dividing it into two channels. A series of pouches, five in number, capable of great dilatation, and provided with a muscular apparatus for retaining or expelling their contents, communicate by large orifices with the nasal canals, and appear to correspond in situation with the antra, frontal sinuses and ethmoid cells. The author gives a minute anatomical description of these muscles, and an account of their modes of action; the adjustments of the apparatus being such that the outer passage may be closed or opened above or below the anterior pouches. When the outer passage is closed, the posterior pouches can be distended and the anterior emptied; while the converse may be effected when the passage is open. The use of the pouches appears to be to buoy up the head, so that on the porpoise rising from deep water, the opening for breathing comes first to the surface and admits of the animal's sleeping in that position, while its whole body remains immersed in the water.

"On Motion in the Lumbar Division of the Spine in Birds." By George Oakley Fleming, M.D., F.L.S. Communicated by Thomas Bell, Esq., F.R.S.

The author gives quotations from the works of Cuvier, Blumenbach, Tiedemann, Macartney, Vicq d'Azyr, Carus, Earle, and Roget, in proof of its being the prevalent opinion among comparative physiologists that the dorsal and lumbar portions of the spine form altogether a rigid structure, not admitting of the least perceptible flexion. But from his observations of the form of the articulating surfaces of the lumbar vertebræ, which appear to be adapted to lateral motion, the author was led to conclude that, although flexion in the mesial plane is effectually prevented, some degree of lateral flexion actually takes place. The number of articulations in this part of the spine, he observes, varies in different birds: thus in the sea-gull, there are several articulations in the dorsal and lumbar portions; while, in the peacock, there is only one moveable vertebra; the remaining dorsal being united together, and all the lumbar vertebræ being consolidated and anchylosed with the sacrum; thus forming two firm and immoveable pieces between which the moveable vertebra is placed. The flexion of the spine forwards is prevented by the great breadth of the spinous processes and their projections at right angles to the bodies of the vertebræ; and frequently also by the addition of a number of thin, flat long bones which are applied by their flat surfaces on each side of the spinous processes; and also by strong flat ligaments, situated between each spinous process, like the ligamentum nuchæ of herbivorous quadrupeds. For the purpose of guarding against pressure on the spinal cord during the lateral flexion of this part of the spine, the spinal canal is enlarged laterally at the centres of motion. The paper is illustrated by drawings of the parts described.

March 19, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"Investigation of the Power consumed in overcoming the Inertia of Railway Trains, and of the Resistance of the Air to the motion of Railway Trains at high velocities." By P. W. Barlow, Esq., F.R.S., M.I.C.E.

The object of the author in this inquiry is to obtain a more correct knowledge than has hitherto been possessed of the resistances which the air opposes to the motion of locomotive engines at great velocities, and of the loss of force arising from increased back pressure and the imperfect action of the steam. For this purpose he institutes a comparison between the velocities actually acquired by railway trains with those which the theory of accelerated motion would have assigned; and his experiments are made not only on trains propelled by a locomotive engine, but also on those moving on the atmospheric railway, which latter affords valuable results, inasmuch as the tractive force is not subject to the losses at high velocities necessarily incident to locomotive engines. A table is given of the theoretical velocities resulting from calculation founded on the dynamical law of constant accelerating forces, in the case of trains of various weights, impelled by different tractive forces, moving from a state of rest; and is followed by another table of the observed velocities in Mr. Stephenson's experiment on the Dalkey line; the result of the comparison being that in a distance of one mile and a quarter, the loss of velocity is about one-half of the observed velocity.

A series of experiments on locomotive lines is next related; but the comparison is less satisfactory than in the former case, because the tractive force cannot be so accurately estimated; it is however sufficiently so to establish the fact, that the power lost by the locomotive engine below the speed of thirty miles per hour is so small as to be scarcely appreciable, and that the time and power which are absorbed in putting a railway train in motion is almost entirely required to overcome the inertia of the train, and does not arise from any loss or imperfection of the engine. It appears, from these experiments, that above one-fifth of the whole power exerted is consumed in putting the train in motion at the observed velocity. The author then enters into some general remarks on the effects arising from this source of loss of power, and the practical application of the knowledge thus obtained. In the atmospheric railway, he finds that the tractive force of a fifteen-inch pipe is so small (being less than half that of a locomotive engine), that the time of overcoming the inertia must limit the amount of traffic which can be carried on a single line, especially with numerous stations. When a great velocity is obtained, the tractive force of the locomotive is much reduced, and therefore a much greater velocity can be attained on an atmospheric railway.

The inquiries of the author into the amount of resistance exerted by the air on railway trains lead him to the conclusion that in the atmospheric railway the loss of tractive power of the piston from friction, &c. is very inconsiderable; and that the resistance of the air is less than had been hitherto estimated, not exceeding, on an average, ten pounds per ton on the average weight of trains.

A tabular statement is then given of the results of the experiments made by the British Association, for the purpose of comparing them with those obtained by the author from his own observations, and more particularly from his experiments on the Croydon Atmospheric Railway. The general conclusion which he draws from this investigation is that the resistance of the air in a quiescent state is less than had been previously estimated, and that the ordinary atmospheric resistance in railway progression arises from the air being generally itself in motion, and as the direction of the current is almost always oblique, from its producing increased friction in the carriages themselves. This kind of resistance will not increase as the square of the velocity; and as it is the principal one, it follows that the resistance to railway trains increases in a ratio not much higher than the velocity, and that the practical limit to the speed of railway travelling is a question, not of force, but of safety.

March 26, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

George Newport, Esq. was elected a Fellow of the Society.

"On the Muscularity of the Iris." By Professor Maunoir, of Geneva. Communicated by P. M. Roget, M.D., Sec. R.S.

The author has satisfied himself, from the result of his own dissections, as well as from the concurrent testimony of a great number of anatomists, that the iris is provided with two sets of muscular fibres, the one orbicular, immediately surrounding the pupillary margin and acting as a sphincter; the other, extending in a radiated direction from the exterior circumference of the former to their insertions into the ciliary ligament, their action being to enlarge the pupil. One-fourth of the disc of the iris is occupied by the orbicular, and the remaining three-fourths by the radiated muscle. The author has examined the structure of the iris in a great number of animals, and states the results obtained by M. Lebert, whom he applied to on this occasion, from numerous dissections of the eyes of animals belonging to each class of vertebrata. He also refers to a work which he published in the year 1812, entitled "Mémoire sur l'Organisation de l'Iris," for evidence of the muscularity of the iris which he obtained by applying galvanism to the human eye immediately after decapitation; and he concludes with the narrative of the case of a woman in whose iris there had been formed, by an accidental wound with the point of a knife, a triangular aperture below the pupil. This aperture became dilated when the pupil was contracted, and *vice versâ*; thus furnishing a proof that its movements were effected by muscular action.

April 2, 1846.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

Major Cautley was elected a Fellow of the Society.

Contributions to the Chemistry of the Urine. Part II. "On the Variations in the Alkaline and Earthy Phosphates in Disease." By Henry Bence Jones, M.D., Fellow of the Royal College of Physicians. Communicated by Thomas Graham, Esq., F.R.S., &c.

The analyses, of which the results are given in a series of tables, were made by the author, chiefly from the urine of patients labouring under different diseases in St. George's Hospital, and therefore nearly under the same circumstances as far as exercise was concerned. He found that the variations in the earthy phosphates were in general independent of the nature of the disease. In fractures of the spine and paraplegia, however, the total amount of these salts was slightly above the healthy standard during the early period, and when inflammatory action might be considered as prevailing; but when this action had subsided, and the affection had become chronic, the total quantity of phosphatic salts was less than natural. In chronic diseases of the brain, and in chronic and even in acute diseases of the membranes, no increase of these salts was observed. In fractures of the bones of the skull, when inflammation of the brain supervened, there was a slight increase of the total amount of phosphates; but no such increase occurred when the head was not affected, even although acute inflammation of other organs existed. In acute inflammation of the brain there was an excessive secretion of phosphates, which returned to the natural quantity as soon as the inflammation passed into the chronic state. In some functional diseases of the brain, attended with delirium, the secretion of the salts was excessive; but the excess ceased with the disappearance of that symptom. In other functional diseases, as in fevers, no excess was observable. In delirium tremens, when food could be taken, there was neither excess nor deficiency; but in the most violent cases, where no food could be taken, the quantity of the phosphates was diminished in a most remarkable degree. In the general paralysis of the insane, no increase of phosphates was observed. One case of acute paroxysm of mania showed a small increase during the paroxysm; in two other cases of mania there was a diminution of phosphates approaching to that occurring in delirium tremens. Bright's disease, even attended with acute inflammation, showed no increase. When only a few ounces of urine were secreted, as in dropsy, no increase was observed; and none also in a very extreme case of exostosis. In the case of mollities ossium, there was a decided increase of the earthy phosphates; and at last, the alkaline phosphates were also in excess, although there was no indication of affections of the nervous structures.

The following are the general conclusions which the author draws from his inquiries: first, that acute affections of the nervous substance, organic and functional, are the only diseases in which an excess of phosphatic salts appears in the urine; and in acute inflammation of the brain, its amount is proportional to the intensity of the inflammation; secondly, that in a large class of functional diseases of the brain, of which delirium tremens presents the most marked example, the secretion of phosphates is most remarkably diminished; and lastly, that no chronic disease exhibits any marked excess in the total quantity of phosphatic salts secreted, at least as far as the mode of analysis employed by the author can be regarded as conclusive.

"On the effects produced by Poisonous Fish on the Human Frame." By Sir William Burnett, M.D., K.C.H., Vice-President of the Royal Society.

The author communicates a report which he lately received from Mr. Jameson, the surgeon of the flag ship at the Cape of Good Hope, of the rapidly fatal consequences ensuing from eating small portions of the liver of a fish, known at the Cape by the name of the *Bladder* or *Toad fish*, the *Aptodactylus punctatus*, or *Tetrodon* of Cuvier. The symptoms were chiefly pain and burning sensation at the epigastrium, constriction and spasm of the fauces and muscles of deglutition, rigidity of the tendons, coma, paralysis and convulsions, following one another in quick succession, and terminating in death within twenty minutes after the poisonous food had been taken. Several other instances of the same kind are next related; and a narrative is subjoined of the case of a seaman who lost his life, with similar symptoms, from the bite of a water snake in Madras roads; the *Coluber laticaudatus* of Linnæus (*Hydrus colubrinus* of Shaw); and also of a ship's company who were all severely affected by eating portions of a large *Banacuda* (*Perca major*).

The author ascribes the symptoms induced by these deleterious substances to their action on the nervous system alone, there being evidence of congestion only, but not of inflammation, in the stomach and other viscera.

"Further Researches on the Nervous System of the Uterus." By Robert Lee, M.D., F.R.S., Fellow of the Royal College of Physicians.

The author states, that on the 8th of April 1838, he discovered, in dissecting a gravid uterus, structures which had a striking resemblance to ganglionic plexuses of nerves; and, in the following December, he traced, in another gravid uterus, the sympathetic and spinal nerves into these new structures. He requested several distinguished anatomists to examine these dissections, and to compare them with similar dissections of the unimpregnated uterus, which he had made in the course of the same year. He then quotes, at some length, the opinions given by these several referees after their examination; and which appear, for the most part, to be favourable to the views of the author, namely, that the structures in question are not mere fibrous tissues, but that they possess the character of nerves, and that they augment in size with the enlargement of the uterus during pregnancy. Among those to whom the preparations were submitted for examination, however, two persons declared it to be their opinion, which they founded on observations with the microscope, that the filaments regarded by the author as nerves, are bands of elastic tissue only, and not plexuses of nerves; and the author, on receiving this intimation, withdrew the paper which he had presented to the Royal Society, and which had been read on the 12th of December 1839, in which paper the appearances displayed in his dissections were minutely described and delineated.

The author next proceeds to give the history of his subsequent researches on the same subject, which he extended to the corresponding parts in some of the larger quadrupeds; and from all these he obtained accumulated evidence of the truth of his original opinions. He also adduces the testimony of various observers, in addition to those he had before cited, which are all in accordance with his own views, as they are expressed in his paper, printed in the Philosophical Transactions for 1841, an Appendix to which was published in the volume of the same work for 1842. Later observations and dissections have served only to confirm him in his opinions; and he considers them as establishing the fact that the nerves of the uterus are considerably enlarged during the gravid state of that organ.

The author concludes his paper by giving a report, drawn up by Mr. John Dalrymple, of the results of his microscopic examination of the uterine nerves in preparations furnished by the author, which tend to corroborate his views.